Modernizing Living Collections Management in an Historic Landscape

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Missouri Botanical Garden

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Executive Summary

The Missouri Botanical Garden (MBG) is regarded as one of the world's leading botanical gardens and is a National Historic Landmark with a 154-year history. MBG manages historic landscapes and living collections beloved by 800,000 annual visitors and provides valuable research and conservation services to the scientific community. MBG's living collections serve as the basis for meeting key horticultural, educational, research, and conservation goals and are of critical importance to multiple constituencies, including staff, Garden visitors (onsite and on-line), and scientists and conservationists working at local and international levels. In order to ensure top-quality collections care and maintenance, meet programmatic goals, and serve important audiences, the living collections must be adequately tracked, documented, labeled, interpreted, and curated. Comprehensive information about the collections must be easily accessible to multiple audiences in multiple formats.

Until 2012, MBG was using an outdated database sytem, which after years of iterative development, reached the stage where an entirely new platform was needed. In order to preserve best practices in collections curation, a new web-based Living Collections Management System (LCMS) was developed that uses the latest web-aware technologies. The LCMS facilitates curation, documentation, inventory control, plant care, and interpretation so that the living collection can provide the highest possible value for research, conservation, and education. The LCMS is being developed with widely-used tools and techniques and has been shared with collaborating institutions and interested botanical gardens. This "cloud-based" system is revolutionary in the botanical garden community and a way for botanical gardens to improve upon essential plant records tools for documenting living collections.

Although the new database uses the latest web-aware technologies, the processes utilized for data collection were very antiquated. Data collection for living collections management encompasses various activities, such as routine mapping of new plants, inventorying of plant collections, and tree assessment surveys. Data were typically recorded on paper forms and later entered into a database back in the office, which was time consuming and prone to error. A new data collection system was needed that would allow mobile, real-time data entry directly into the collections management database.

Using funding from the National Center for Preservation Technology and Training (NCPTT), MBG successfully developed, tested, and disseminated a modern data collection system. This system advances the process of data collection using modern technology to solve many of the challenges and issues with paper-based methods. Utilizing mobile tablet computers and QR code technology, the data collection system interfaces directly with the LCMS. This data

collection system aids in preserving MBG's historic living collections and will help other gardens nationwide manage their living collections.

Introduction

The mobile data collection system developed under this grant is a component of Missouri Botanical Garden's new Living Collections Management System (LCMS). The LCMS is built in SQL Server, a global standard relational database system, with strong integration to Environmental Systems Research Institute (ESRI) mapping software, and provides a stable and robust platform for daily operations and programmatic growth. Using web-based data entry screens, plant records staff enter data on each plant that enters the collection. Each plant is assigned an accession number which is linked to information on the name, the source of the plant, and its location in the Garden. While the new database uses the latest web-aware technologies, MBG did not have processes in place to modernize the collection of data for ongoing tracking of collections.

With funding from the NCPTT grant, Missouri Botanical Garden set about solving key challenges for data collection during inventorying and tracking of living collections. Accurate and efficient data collection which encompasses activities such as routine mapping of new plants, inventorying of gardens, and tree assessment surveys is critical in focusing development, maintaining long term health, ensuring the highest level of relevance and preservation of historic elements of living plant collections. Most gardens currently perform data collection by printing records on paper and then writing notes in the field, updating database records on the computer when back in the office. Recognizing a significant opportunity to modernize and bring efficiency to this process, the new mobile data collection system developed under this grant consists of simplified web forms that display clearly on mobile devices such as mobile phones and tablets. These forms include icons for commonly performed tasks, such as performing inventories and taking pictures. They allow staff to minimize the number of clicks required to perform each task, and put the tools necessary for recording information on collections directly in the hands of horticulturists. Data collected with the mobile tools updates collections information directly in the LCMS, making the process much more accurate and efficient.

Methods and Materials

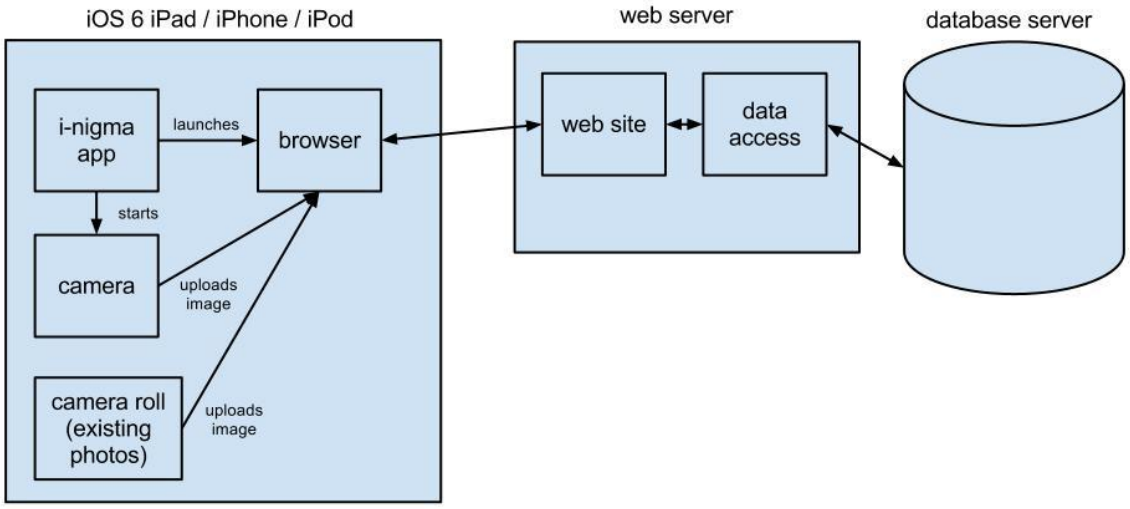
Simple web forms were designed and built which can be displayed on screens as small as an iPhone, but also display well on tablets and desktops. The content for these were created through a process of reviewing existing workflows and paper forms. The main goal during development was to focus on repetitive tasks and minimize the number of steps needed by the

users to perform them, and these tools came to be known as *Mobile Tools*. At the end of the build process, the *Mobile Tools* were tested by MBG staff and project partners. This resulted in several rounds of refinements. An example of the final web forms can be seen in (Attachment H).

The LCMS is a website and can be used by many different hardware platforms, including desktop, iPad/iPhone/iPod and Android phones/tablets. The approach was to extend the site, rather than develop the many specialized applications necessary for different devices.

For icons, Glyphish Pro (v3) was purchased. For QR code scanning, we chose the i-nigma app, http://www.i-nigma.com/i-nigmahp.html, free from the App Store and Android Market. This app will simply scan a QR code with an embedded URL and automatically launch Safari. For image uploading, most platforms have web browsers that provide simple file upload capability using the regular HTML file upload element (input element, type="file"). The recent release of the Safari browser in iOS 6 finally includes this capability.

There were no database changes required to our system to support this activity. We integrated with existing planting inventory, planting measurement, and image tables.



Software used include the following:

- SQL Server
- Windows Server 2008
- Internet Information Services (IIS) for Windows Server
- ESRI ArcGIS 10.1
- ArcGIS Javascript API for embedded maps in web pages
- ASP.NET web application framework (C# code)
- Symantec Mobile Management 7.1 (MMS); plugs into Altiris 7.1 infrastructure

Servers used include the following:

- Web Server (CBIWEBSERVER)
- Image Server (MBGSERV18)
- GIS Server (GISNG)
- File Server (MBGSERV14)
- Application Server (MBGSERV09)
- Database Server (MBGSERV21)

Results and Discussion

At the start of our grant, our first task was to research, acquire and evaluate several tablet computer options available for mobile data collection. Several popular models were purchased by the Information Technology Division, five of which were based on the Android OS, and two Apple iOS devices. The tablets purchased were: Asus Transformer, Asus Transformer Prime, Motorola Xoom, Samsung Galaxy Tab, Kindle Fire, iPad 2, and the New iPad. The tablets were tested by staff from the Horticulture Division, and several features were reviewed and rated. Features were weighted based on importance to the collection of data on plants. The New iPad ranked first in the staff assessment, the iPad 2 ranked second, and the Asus Transformer Prime ranked third. The detailed results of the tablet assessment are below:

MBG Tablet Assessment - Horticulture

	Samsung	Asus A	Asus B	Motorola	Kindle	iPad2	iPad3	Weight
Size	5	4	5	5	4	5	5	10
Weight	5	4	5	4	5	4	4	11
Screen visibility	3	3	4	2	2	4	5	13
Camera	5	3	4	2	0	2	5	12
Battery life	3	3	3	3	3	5	5	8
Speed	2	2	5	4	4	5	5	9
Ease of use	3	3	3	3	3	5	5	15
Longevity of hardware	2	2	2	2	3	5	5	7
Longevity of software	2	2	2	2	3	5	5	6
Stability in daily operation	2	2	4	3	3	5	5	16
Memory expansion*	0	1	1	1	0	0	0	1
Flash*	1	1	1	1	1	0	0	2
ESRI mapping API	2	2	3	3	2	5	5	14
File management	5	5	5	5	3	1	1	5
Multi-user support	4	4	4	4	3	3	3	4
Available apps	3	3	3	3	1	5	5	3
Maintainability	2	3	3	4	1	1	1	12
Supportability	2	2	2	2	2	2	2	12
Manageability	3	3	3	3	1	4	4	12
Unweighted points total	54	52	62	56	44	66	70	
Unweighted rank	5	6	3	4	7	2	1	
Weighted points total	513	481	600	526	421	661	710	
Weighted rank	5	6	3	4	7	2	1	

0=feature absent
1=feature present or poor
2=fair
3=average
4=good
5=excellent

*if a feature was either present or absent, a rating of 0 (absent) or 1 (present) was used

Based on the results of the tablet assessment, 11 New iPads were purchased and configured. Other equipment that was researched and purchased include a Verizon Mifi mobile hotspot and a Zebra mobile barcode printer. Simultaneously, our developers also began designing and developing the database interfaces and mobile data collection screens for tree assessment, plant inventories, and QR code integration, as well as photo integration using the camera embedded in the New iPad.

The inventory tool application was presented at the Annual Public Gardens Association annual conference in Columbus, Ohio in June 2012. We shared our approach, provided a live demonstration, and shared some best practices and lessons learned in developing the system. We also held an informal workshop later in the week to further share details of the new system to interested staff from other gardens. Details of the application were shared at the Environmental Systems Research Institute (ESRI) International User Conference in San Diego, California in July 2012. In Fall of 2012, an article about the new LCMS and mobile tools appeared in the Missouri Botanical Garden Bulletin entitled "A Living Museum: Technology Tranforms Plant Collections Management". Several other e-mails, articles, demonstrations, and presentations continue to occur as interest in this groundbreaking system remains steady.

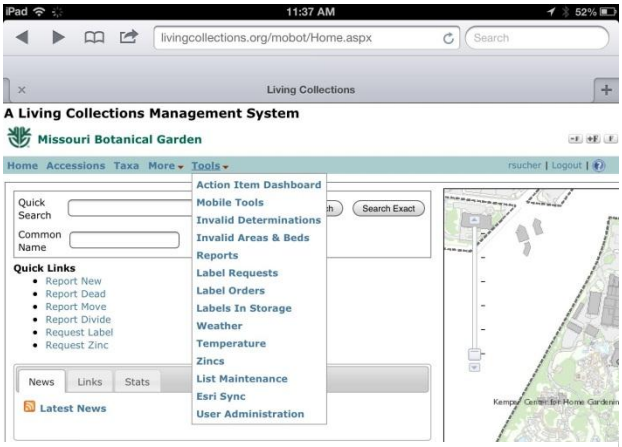


Figure 1: Mobile Tools accessed from the Home Screen

The 11 iPads were handed out to Horticulture supervisors in September 2012. Supervisors were trained on the general use of the iPads, and were also shown how to access *Mobile Tools*. A prominent link was made on the LCMS home screen (Figure 1). Over the course of 4 months, staff were encouraged to test the system and submit any questions or comments to Rebecca Sucher.

In December, a guest login was created for demo purposes, and a survey was distributed to staff at MBG, Desert Botanical Garden (DBG), Red Butte, and UC Davis. Feedback was positive. Most staff were most impressed with being able to have plant records data at their fingertips, but others listed QR code scanning abilities and taking photos of plants as favorite features. A few bugs were reported and worked out, additional training was performed in areas that generated confusion, and 2-3 extra features were added to the tools.

Currently, staff check out one of two wifi hotspots in order to be able to use the iPad's mobile tools out in the Garden. However, efforts to install wifi Gardenwide are proceeding, and 6 new wifi access points have been added to the grounds. Also, 30 iPad minis have been purchased using funds from another grant, which will allow every horticulturist to have one.

Conclusions

Mobile Tools, a modern field data collection system for living plant collections in botanical gardens, is enabling staff to collect the most comprehensive, accurate, and up-to-date data available, supporting the curation of the Garden's world class living collections. With *Mobile Tools*, staff are recording the planting of a new plant as it is planted, including placing the new plant on a map, taking photos and associating them with database records, and recording measurements and plant assessments with a few taps of a finger. This process is transforming the way living collections are recorded. Development of *Mobile Tools* has resulted in more comprehensive and accurate records, and more ownership and pride in each horticulturist's collections. The *Mobile Tools* developed under this grant are also a great jumping-off point to add more functionality in the future.

This project provided an innovative approach to data recording for living collections management and will strengthen MBG's ability to serve the public and other museum professionals. The overall outcomes of this project were:

- Improved care and management of MBG's living collections.
- Increased public awareness, knowledge, and appreciation of MBG's living collections by providing them with more information collected via Mobile Tools.
- Provided training and guidance to other gardens on best practices of living collections management.

The creation of Mobile Tools supported by NCPTT was highly successful and is now an integral part of the collections management process at MBG. All of the grant deliverables were achieved. We wish to thank NCPTT for the support in achieving success for this critical project. We firmly believe the use of Mobile Tools will revolutionize the management of living collections and, based on our experiences, will become commonplace in the coming years.

Acknowledgements

The Missouri Botanical Garden wishes to express its appreciation to the following project partners, whose help and support contributed to the success of this project:

National Center for Preservation Technology and Training (NCPTT)
Environmental Systems Research Institute (ESRI)
American Public Gardens Association (APGA)
University of California, Davis

Desert Botanical Garden
Red Butte Botanical Garden

Attachments

A. Initial press release

B. Final press release

C. Electronic images

D. Article summarizing the work funded by the grant

E. Interim Report

F. Administrative Summary

G. SF-425

H. Web application details

I. Best Practices for Data Collection and Creation of a Database Schema

J. Workshop/Webinar illustrating management process